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Sociomateriality in the age of emerging information technologies: How big data analytics, blockchain and artificial intelligence affect organisations

By
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Certificate of original authorship

I, Mark van Rijmenam, declare that this thesis, is submitted in fulfilment of the requirements for the award of the Degree of Doctor of Philosophy in the field of Management at the Faculty of Business at the University of Technology Sydney. This thesis is wholly my own work unless otherwise reference or acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

This document has not been submitted for qualifications at any other academic institution.

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Thesis format

This thesis is a thesis by publication. That means that this thesis consists of three papers that are published/publishable, which are linked together using the introduction, literature review and discussion. It is structured as a single manuscript and the introduction, literature, the three papers, the discussion and the conclusion are separate chapters. The literature review as well as the three papers are distinct, but they are linked in a logical and coherent way.

Papers included & statement of contribution

The following papers are included in this thesis:

	Title	Lead author	Co-author 1	Co-author 2	Co-author 3
Paper 1	Avoid being the turkey: How Big Data analytics changes the game of strategy in times of ambiguity and uncertainty – published in Long Range Planning	Mark van Rijmenam	Tatiana Erekhinskaya, Lymba Corporation, United States – assisting with the data analysis using machine learning and NLP. Contribution approximately 20%	Assoc. Prof. Jochen Schweitzer, University of Technology Sydney, Australia – Primary PhD supervisor providing feedback	Prof. Mary-Anne Williams, University of Technology Sydney, Australia – PhD Co-supervisor providing feedback
Paper 2	A Distributed Future: How Blockchain Changes Organisation Design – under review with Group & Organization Management	Mark van Rijmenam	Assoc. Prof. Jochen Schweitzer, University of Technology Sydney, Australia – Primary PhD supervisor providing feedback	Prof. Mary-Anne Williams, University of Technology Sydney, Australia – PhD Co-supervisor providing feedback	
Paper 3	How to build responsible AI? Lessons for governance from a conversation with Tay – Under review with California Management Review	Mark van Rijmenam	Assoc. Prof. Jochen Schweitzer, University of Technology Sydney, Australia – Primary PhD supervisor providing feedback	Prof. Mary-Anne Williams, University of Technology Sydney, Australia – PhD Co-supervisor providing feedback	

The above-stated information is correct:

Mark van Rijmenam	Tatiana Erekhinskaya	Associate Prof. Jochen Schweitzer	Prof. Mary-Anne Williams
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Table 1: Papers and contribution of co-authors

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Abstract

Emerging information technologies (EIT), such as big data analytics, blockchain and artificial intelligence (AI), challenge organisation design and strategic management, and bring the role of data in organising to the fore. Big data analytics empower consumers and employees, resulting in open strategy and a better understanding of the changing environment. Blockchain enables peer-to-peer collaboration and trustless interactions. And, AI facilitates new and different levels of involvement among human and artificial actors. From these interactions and responses, new modes of organising are emerging, where technology facilitates collaboration between stakeholders and where human-to-human interactions are increasingly replaced with human-to-machine and even machine-to-machine interactions. In this doctoral research, I use the theory of sociomateriality to untangle the social and material when dealing with EIT within organisations. I endeavour to explore these theoretical issues and present a new understanding of the relationships between the social, material and artificial.

Addressing this context, my research consists of three studies. Each study is arranged as a standalone paper. In the first study, I investigate how big data analytics affect can be used to better understand the changing organisational environment. The second study looks at how blockchain can result in new forms of organisational design and how it changes decision-making. In the third study, I seek to answer how organisations can ensure that artificial intelligence performs as planned. The results are discussed and made tangible by exploring how the social, material and artificial are changing collaboration among those actors involved in organisations.

I adopt three methodologies. The first study is a meta-synthesis of 101 peer-reviewed papers. The second study is conceptual and in the third study, I use qualitative research methodologies to interview managers of organisations who developed conversational AI.

The significance of this research is twofold. First, my academic contribution lies in understanding how big data analytics affect strategic management theory in general, and dynamic capabilities literature in particular; how blockchain requires us to rethink organisation design theory, and how agency theory can help when dealing with artificial actors. Also, I argue for the addition of the artificial as an independent actant in organisation design theories. Second, my findings inform organisational practice in terms of how to design organisations using EIT in an increasingly data-driven world. The key thesis underlying this research is that emerging information technologies change how we organise activities within organisations.

Acronyms

AGI: Artificial General Intelligence

AI: Artificial Intelligence

ANT: Actor-Network Theory

CEV: Coherent Extrapolated Volition

DAO: Decentralised Autonomous Organisation

DApp: Decentralised Application

DARPA: Defense Advanced Research Projects Agency

DNS: Domain Name Servers

DQM: Data Quality Management

EIT: emerging information technologies

ETH: Ethics

FAQ: Frequently asked questions

GE: General Electric

HMN: Human-Machine Network

ICB: Industry Classification Benchmark

IPFS: InterPlanetary File System

IoT: Internet of Things

IT: Information Technology

KPI: Key Performance Indicator

MDM: Master Data Management

MNE: Multinational Enterprise

NAI: Narrow Artificial Intelligence

NLP: Natural Language Processing

PBFT: Practical Byzantine Fault Tolerance

PKI: Public Key Infrastructure

PoS: Proof of Stake

PoW: Proof of Work

SAI: Super Artificial Intelligence

SHA: Secure Hash Algorithm

SME: Small and Medium Enterprise

SMS: Strategic Management Society

SSL: Secure Sockets Layer

USC: Utility Settlement Coin

UTS: University of Technology, Sydney

XAI: Explainable AI

Y2K: Year 2000